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Lehigh University Cognitive Science Program

CogSci News

Cognitive Science Program, Lehigh University, Bethlehem, PA.

Volume 5, Number 1
Spring 1992

Editorial Policy

This newsletter is published twice each year, in fall and spring issues, by the Cognitive Science Program at Lehigh University. Its purpose is to inform faculty and students about the interdisciplinary and rapidly growing field of cognitive science and to report the activities of Lehigh's Program.

The newsletter is distributed free of charge in the United States and Canada to academic programs and individuals interested in cognitive science. Anyone who would like to be added to the mailing list should notify the Editor.

The Editorial Staff welcomes readers' comments and *solicits materials* dealing with cognitive science. We are especially pleased to consider course syllabi, book reviews, short essays, brief descriptions of scholarship and research in progress, and original art work (e.g., cartoons, line-drawings, computer-generated images).

Address all submissions, comments, and subscription requests to: John B. Gatewood, CogSci News, Lehigh University, 681 Taylor St., Bethlehem, PA 18015-3169. Send electronic mail to jbg1@Lehigh.edu.

Lehigh Revises Cognitive Science Major

Edwin J. Kay
Director, Cognitive Science Program
Lehigh University

The Cognitive Science Program at Lehigh was initiated in the fall of 1986. After six years, i.e., in the spring of 1992, the Cognitive Science Supervisory Committee has decided to make some changes to the original undergraduate curriculum. Below, I describe the original curriculum and then discuss the changes we have made to it as well as the reasons. In a number of cases, I will refer to the number of credit hours for a course. Lehigh's semesters are 16 weeks long, including a two week exam period, and a typical course meets three times a week (42 classroom hours throughout the semester) for three credits.

Cognitive science is a bachelor of arts major in the Lehigh's College of Arts and Science. Most of the major programs in the college are directed by departments, whereas the cognitive science major is directed by an interdisciplinary committee. Most courses in the major are drawn from the departments. Although the Cognitive Science Program does offer a few courses under its own course designator—"CogS"—these, too, are staffed by members of various participating departments.

The original curriculum required a minimum of 47 credits, considerably more than the typical social science or humanities B.A. program (which range from 30-38 credits). Its requirements were as follows.

Introduction to Cognitive Science (7 credits), a sequence of two sophomore year courses: CogS 101 covering the conceptual underpinnings and history of cognitive science, and CogS 102 covering the mathematical tools most widely used in cognitive science.

Collateral Requirements (7-11 credits): differential calculus, and structured programming and data structures.

Disciplinary Core Courses (12 credits), four courses, one from each of the disciplines most central to cognitive science:

- Psyc 117 Cognitive Psychology
- CogS 140 Introduction to Descriptive Linguistics
- Phil 250 The Minds of Men and Robots
- CSc 327 Artificial Intelligence Applications

Major Electives (18 credits), two courses from any three of the following areas:

Artificial Intelligence and Expert Systems
- CSc 262 Programming Languages
- CSc 365 Natural Language Understanding
- CSc 368 Artificial Intelligence Programming

Formal Models
- Phil 114 Fundamentals of Logic
- Phil 214 Logical Theory
- CSc 261 Discrete Structures (calculus prerequisite)
- CSc 318 Automata and Formal Grammars

Philosophy
- Phil 139 Contemporary Philosophy
- Phil 220 Knowledge and Justification
- Phil 251 Action, Free Will, and Fate

Cognitive Psychology
- Psyc 307 Seminar in Cognition
- Psyc 320 Psycholinguistics
- Psyc 351 Cognitive Development in Childhood

(continued on page 2)

Curricular Changes (cont.)

Sociocultural Influences on Cognition
- SPsy 135 Human Communication
- SPsy 314 Attitudes, Attributions, and Actions
- Anth 376 Mind, Self, and Culture

Neuroscience
- Psyc 176 Introduction to Cognitive Neuroscience
- Psyc 177 Introduction to Physiological Psychology
- Psyc 373 Sensation and Perception
- Psyc 375 Neuroanatomy of Behavior

Senior Seminar (3 credits).

Although the original curriculum remains, in our view, pedagogically sound, it attracted relatively few students. This fact prompted a reassessment of the requirements as they appear from a student's perspective. Examined in this way, most of the problem seemed to stem from the structure and timing of the B.A. degree in the College of Arts and Science.

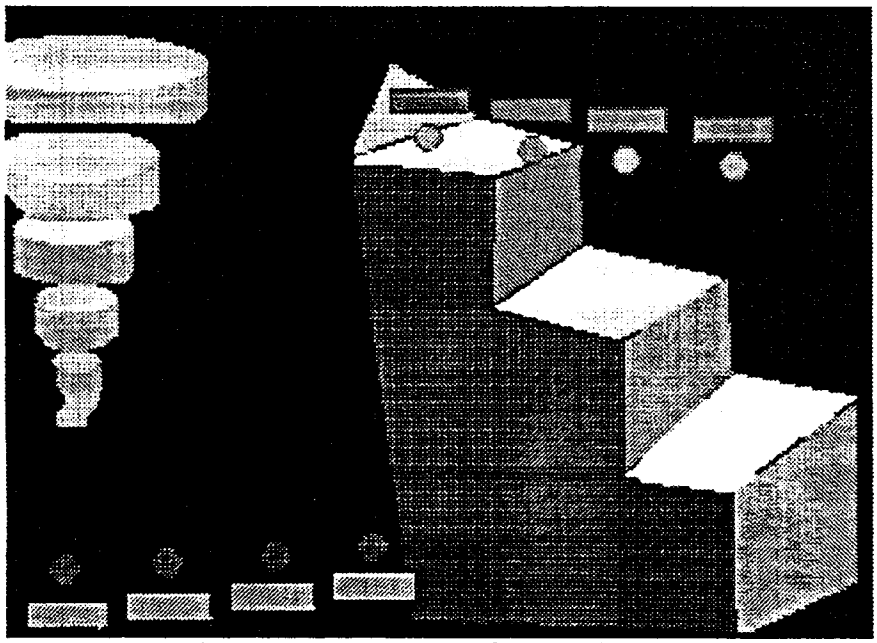
Students in the college must declare their major by the middle of their fourth semester, but many often do so at the end of their first year or at the beginning of their sophomore year. Because the first introductory course in cognitive science was not available to freshmen, many students had already declared a major before having any exposure to cognitive science. Thus, our first change was simply to renumber the introductory course—from CogS 101 to CogS 7—so as to make it available to first year students.

The second change also involved the introductory sequence. We discovered that CogS 102 (the formal models introductory course) overlapped substantially with a lower level mathematics course. Further, because the Cognitive Science Program depends on faculty volunteered by other departments to teach its courses, it has been difficult staffing the second semester's introductory course. Thus, we simply dropped CogS 102 from the course catalog and added its counterpart, Math 9, as a collateral requirement for the cognitive science major.

At the same time, we re-thought the role of differential calculus in our curriculum. With the exception of a single "major elective" course, differential calculus was not a prerequisite for any other course in the major. Further, the committee felt that one could be the compleat cognitive scientist without differential calculus. Thus, we removed it as a collateral requirement, warning students that differential calculus is prerequisite to CSc 261.

The final change involved the introductory linguistics course, which is offered by the Cognitive Science Program in the absence of linguistics courses elsewhere in the university. To give it greater visibility, we cross-listed it with Anthropology, Psychology, and Modern Foreign Languages.

After these changes, the new curriculum consists of a minimum of 43 credits as follows.



(computerized image by Stefania Giobbe)

Introduction to Cognitive Science (3 credits): CogS 7, a one semester, first year course.

Collateral Requirements (7-10 credits): finite mathematics, and structured programming and data structures.

Disciplinary Core Courses (12 credits), four courses, one from each of the disciplines most central to cognitive science:
- Psyc 117 Cognitive Psychology
- CogS 140 Introduction to Descriptive Linguistics
- Phil 250 The Minds of Men and Robots
- CSc 327 Artificial Intelligence Applications

Major Electives (18 credits), two courses from any three of the following areas:

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- Phil 114 Fundamentals of Logic
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Sociocultural Influences on Cognition
- SPsy 135 Human Communication
- SPsy 314 Attitudes, Attributions, and Actions
- Anth 376 Mind, Self, and Culture

Neuroscience
- Psyc 176 Introduction to Cognitive Neuroscience
- Psyc 177 Introduction to Physiological Psychology
- Psyc 373 Sensation and Perception
- Psyc 375 Neuroanatomy of Behavior

Senior Seminar (3 credits).

We hope these curricular modifications will increase the attractiveness of the cognitive science major to students in the College of Arts and Science, but only time will tell...

"Introduction to Cognitive Science" Revisited:

Evolution of a Hard-to-Teach Course

Barbara C. Malt
Department of Psychology
Lehigh University

In the fall of 1988, Norman Melchert and I reported on our experiences co-teaching CogS 101, Lehigh's then-brand-new introductory undergraduate cognitive science course. At the time that we wrote our report for *CogSci News* (v1, n2, 1988), our inaugural semester was still in progress. Last week's final exam period closed the fourth year of teaching this course. I report here on our more recent experiences, both good and bad, and how the course has evolved during the four years.

Instructors

When the course was first proposed, the Cognitive Science Supervisory Committee considered staffing possibilities ranging from having a single instructor to having four or more instructors, each of whom would cover one specialty area. Ultimately the committee decided that four or more instructors would produce chaos, but one would not have the expertise to cover the breadth of the field. The happy medium seemed to be to have two instructors with complementary areas of expertise. The first two years, Norman Melchert (a philosopher with interests in artificial intelligence) and I (a cognitive psychologist with interests in language) co-taught the course, emphasizing philosophy, AI, cognitive psychology, and linguistics. Each of us took primary responsibility for lectures in the two areas closest to our expertise, but both attended all classes and helped to stimulate discussion. We also covered some cognitive neuroscience with help from movies and guest lectures. The second two years, Robert Barnes, a philosopher who also has interests in artificial intelligence, rotated in to replace Melchert, and we have retained the same general format. All three of us feel that the team approach has been valuable and should be continued. We have each learned a lot from each other; the students seem to enjoy the interaction with and between the two instructors; and the quality of the coverage has certainly been superior to what it would be from one of us alone.

Student Population

We have seen a substantial shift in the students taking the course from the first year to the fourth. Although the course is 100-level (sophomore), it was heavily populated by junior and senior Engineering College students the first year. Many of these students had already had courses in AI and other related topics, and they were quite sophisticated in their ability to handle cognitive science material. These students seemed to be a "backlog;" they would have taken the course earlier if it had been available. We are now drawing more students in their sophomore year, including more from the Arts and Sciences, most of whom have little related background. Many of the sophomores, in fact, come into in the course with very little idea what cognitive science is. These are really the "right" students for the course. However, the shift has necessitated some major changes in teaching strategies from our first semester, which I will describe in next two sections.

Books

The first semester, we used one central text, *Cognitive Science: An Introduction* by Stillings, Feinstein, Garfield, Rissland, Rosenbaum, Weisler, and Baker-Ward, and we assigned much of the book as required reading. Although the book is fairly heavy going, the students in the first class handled the material well. The following two semesters, we were more selective in assignments from the book, and we used some short supplementary readings. Even so, the students seemed to have more trouble following the text, and they were less enthusiastic about it.

This year, we decided to sacrifice completeness in favor of trying to generate excitement and enthusiasm, and we abandoned the central text. We assigned *An Invitation to Cognitive Science* by Justin Leiber (a 150 page book with a colorful style, which, despite its broad title, focuses mainly on philosophical issues); *The Mind's I* edited by Douglas Hofstader and Daniel Dennett (a collection of short, catchy pieces, mainly by philosophers, on artificial intelligence and related topics), and *Language and Problems of Knowledge* by Noam Chomsky (a small book containing relatively non-technical lectures given in Managua, Nicaragua). We could not find any book on cognitive psychology that had the non-technical style we were looking for, so we used a few relatively easy journal articles and other miscellaneous readings for the psychology section.

We felt that *The Mind's I* was quite successful; the selections were highly readable and generated a lot of enthusiastic discussion. The *Language* book was more difficult going, but we focused on major statements of the Chomsky program in the first two chapters, and we worked through a few of the simpler syntactic analyses in detail with the class. I think the students felt some satisfaction at reading Chomsky himself instead of someone else's account of Chomsky. (We also gave them, mainly for their entertainment, pieces entitled "Chomsky on the **Enterprise**" and "The great Eskimo vocabulary hoax" from *The Great Eskimo Vocabulary Hoax and Other Irreverent Essays on the Study of Language* by Geoffrey Pullum. A few other essays from this book might be usable for undergraduates.) Students and

(continued on page 4)

Has your ADDRESS changed?
Planning to move?

... then please notify us!

(Thank you)

Introductory CogSci (cont.)

instructors alike found Leiber's *An Invitation to Cognitive Science* to be interesting but somewhat confusing.

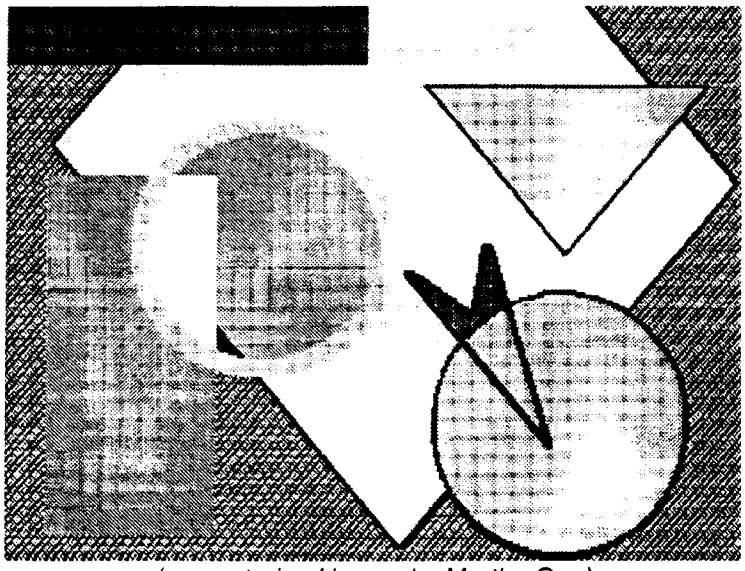
Projects

During the first three years of the course, our assignments were fairly traditional. We used in-class quizzes and exams to assess mastery of the basic concepts for each section of the course, and we gave integrative essay topics two or three times during the semester. This year, we retained a midterm and final exam. As the second major part of our effort to get the students more involved in the material, though, we created four "mini-projects," one for each section, as a major component of the coursework. These required more hands-on involvement of the students with major issues in each of the four contributing disciplines.

The mini-project for the philosophy section required the students to take a stand on Searle's Chinese room problem and to defend their stand. Ultimately the students turned in 5-page individual papers reporting their position. However, before the papers were written, we divided the class into groups for discussion and then devoted a day to debate between the groups. We were pleased (and somewhat surprised) at the amount of energy the students invested in defense of their group's position.

For the psychology section, we introduced issues about mental imagery in class, and spent some time reviewing one set of experiments arguing for emergent properties of images (Finke, Pinker, and Farah, *Cognitive Science*, 1989) and one arguing against emergent properties (Reed, *Memory & Cognition*, 1974). The task for the students was then to try to devise some experiment or other sort of empirical evidence that would help reconcile the apparently contradictory results. They wrote papers describing their experiment. This assignment was probably the least satisfactory of the four. Only one student had had an introductory cognitive psychology course; most of the rest had not had any previous psychology at all. Not surprisingly, their sense of how to design empirical tests of hypotheses was limited.

The artificial intelligence project consisted of an analysis of a conversation program called "Racter." This program is somewhat like Weizenbaum's ELIZA program in that the human participant can sit at a terminal and carry on a wide-ranging conversation with the program for as long as desired. However, the kinds of answers Racter generates, and the structure of the program, are quite different. The students' assignment was to interact with Racter for as long as they wanted, pushing it to the limit with various kinds of questions to try to deduce what sort of knowledge representations and program structure must underlie its performance. They then wrote papers reporting their analysis. This assignment was a popular one, and the papers were quite good.



(computerized image by Martha Gee)

The final mini-project was for the linguistics section. We had devoted a number of classes to working through simple accounts of some syntactic and phonological phenomena in English. The assignment, then, consisted of several examples of simple active declarative sentences in the present tense and their corresponding passive and interrogative forms with present and future tense. The students' task was to provide an account of why certain forms are grammatical and others are not. (For example, "John is a doctor" and "John sees a doctor" are both acceptable declarative forms. By contrast, "Is John a doctor?" is grammatical, but the superficially similar "Sees John a doctor?" is not). We introduced as a hint the idea of auxiliary verbs that might not be overtly expressed in the active forms. Most of the students chose to ignore this hint in their papers, but they did come up with a variety of creative (if not entirely successful) analyses.

Clearly, there are some kinks that could be worked out with these exercises. Overall, though, we feel the projects contributed to a livelier class and more student involvement with the material.

Course Listing

Two final changes to the course are ones that will have their impact beginning next year. These are changes in how the course is presented in the catalog. First, up to now, the course has been a 100-level course aimed at sophomores. However, it is the introductory course for the cognitive science major. Especially when the course is offered in the spring semester, as it was this year, this means that majors get a late start on their program. We may also lose some potential majors who become involved in other programs in the meantime. Therefore, we have renumbered the course to freshman level. Second, we have revised the course description, which up to now has read, essentially, "This is an introduction to cognitive science." We have rewritten the description to include more enticing phrases in familiar vocabulary. We hope this description will draw in a broader set of students who may not have heard of cognitive science before. We anticipate new challenges in introducing cognitive science to these students. Stay tuned for future reports!

Editor's Note: CogSci News *invites contributions describing introductory cognitive science courses, either undergraduate or graduate level, as these are taught at other institutions. Discussions of books, resource materials, and project ideas are also welcome.*

The Strange Case of Bi-Photo-ism:

Paul Churchland as the 8th Annual Selfridge Lecturer in Philosophy

Mark H. Bickhard
Henry R. Luce Professor of Cognitive Robotics
and the Philosophy of Knowledge
Lehigh University

There were some odd antics on the Lehigh campus the last week of February. That's in addition to the usual ones. In particular, there was a man taking pictures in a rather peculiar way: he would take a picture, then move off to the left or right—to the right seemed most common—and take another of exactly the same thing. Every picture was duplicated, but not identically.

Setting aside for the moment any attributive (or referential) questions concerning the mental health of this person of the "everything in twos, but not identical" compulsion (which is heretofore unknown in the literature), we are in a position to identify him: Dr. Paul Churchland, from the University of California, San Diego. Dr. Churchland was visiting Lehigh for the week of February 24 through February 28 as the Eighth Annual Selfridge Lecturer in Philosophy.

Dr. Churchland visited classes, gave lectures, and argued many points with the Philosophy Faculty Seminar. He also participated in a deep exploration of the finer points of horror movies—truly a Renaissance mind. We will review some of the activities, lectures, and discussions of that week, and, perhaps, find some clues concerning the deeper issues underlying the strange "bi-photo" behavior.

Dr. Churchland's philosophical positions are highlighted by one major antagonist and one (or two?) major protagonist. The antagonist—the position of the Forces of Darkness—is the sentential approach to mind and belief: the theory, inherent in standard ways of talking about such things, that beliefs are somehow actual sentences in the mind. Dr. Churchland points out that there are a great many difficulties with such theories. For example, we seem to have an extremely large number of beliefs, such as that "The moon is not made of Pumpernickel bread," or "It is dangerous to be run over by red trucks," and also "It is dangerous to be run over by green trucks," and so on, and it is difficult to figure out where all of those sentences would fit in your standard brain.

Another difficulty is that such an approach seems to put us in a position that is committed to one of two subsidiary alternatives, each equally unacceptable, having to do with the "minds" and "beliefs" of animals. We could conclude, for example, that animals really do have beliefs, as it would appear, and that, therefore, they really do have language-type sentences in their brains, all the way down to very primitive animals, and that there is some additional mystery reason why they cannot communicate those sentences as human beings do. Or, we could conclude that animals don't have any mentality or beliefs, contrary to appearances, and that human beings constitute, therefore, a remarkable, gigantic, saltatory, evolutionary leap away from—and massively different from—all other animals. There do, in fact, seem to be people who hold each of these positions, and charity (and space) precludes our exploring their mental health.

The difficulties of the sentential approach multiply: There are many mental phenomena, such as dreams, skills, perceptions, emotional feelings, and so on, that don't seem to have much to do with sentences; and there is no evidence from brain studies of anything like little sentences (or big sentences) in the neural-ware. Churchland argues that these difficulties, and others, make the sentential approach a very bad bet, and that this point holds even more strongly when consideration is taken of the fact that this way of theorizing about the mind, this way of talking about beliefs, has been around for millennia, and doesn't seem to have made much progress in all that time. It looks like a bankrupt theory.

Churchland's protagonist is contemporary neuroscience and connectionism. His position is, in effect, that these two fields are each addressing the same sort of phenomena, but are not quite identical. Furthermore, and most importantly, they offer an alternative to the sentential approach for understanding the mind.

Connectionism, or Parallel Distributed Processing, is an architecture for processing that is, among other things, massively parallel in its processing, and massively different from sentential models. It is an approach that was motivated by considerations of the way the brain might actually function, and it arguably captures some properties of that functioning. And, there are no sentences in it.

A connectionist network is an organization of simple processors, called nodes—usually organized in layers, usually in three layers—connected by weighted lines of transmission from the nodes of one layer to the nodes of the next layer. Each node computes its own level of activation from the activation levels communicated to it on its input lines, in accordance with the weights on those lines, and in accordance with some generally simple function of those input activation levels—AND in parallel with all the other nodes computing their own updated levels of activation. The first layer receives its activation levels directly from the environment.

So, activation comes into the first layer from the environment, is distributed to the second layer by weighted connections from the nodes of the first layer to those of the second, and then the activation levels of these second layer nodes are computed. The activation levels of the second layer nodes are, in turn, distributed over weighted connections, now to the third layer, whose nodes' activation levels are determined. The third layer is usually the final and output layer.

There are several properties of such networks that have aroused a great deal of interest and controversy. First, the third layer of nodes—the output layer—will

(continued on page 6)

Bi-Photo-ism (cont.)

generally settle into some stable pattern of activations among those nodes, and such output patterns will classify together all the possible input activation patterns that would yield the particular output patterns. That is, a Parallel Distributed Processing network can be a classifier of input patterns.

Second, there are techniques by which the weights on the transmission connections in such a network can be adjusted so as to train the network to classify input patterns in desired ways—such as to distinguish for a submarine sonar reflections indicating sea floor rocks from those reflections indicating mines. This ability to engage in something like learning has been enormously exciting.

Third, it has been demonstrated that such systems can in fact engage in types of classification that had once been thought impossible for such nets. This demonstration opened up the possibility that such nets were capable of human level pattern recognition.

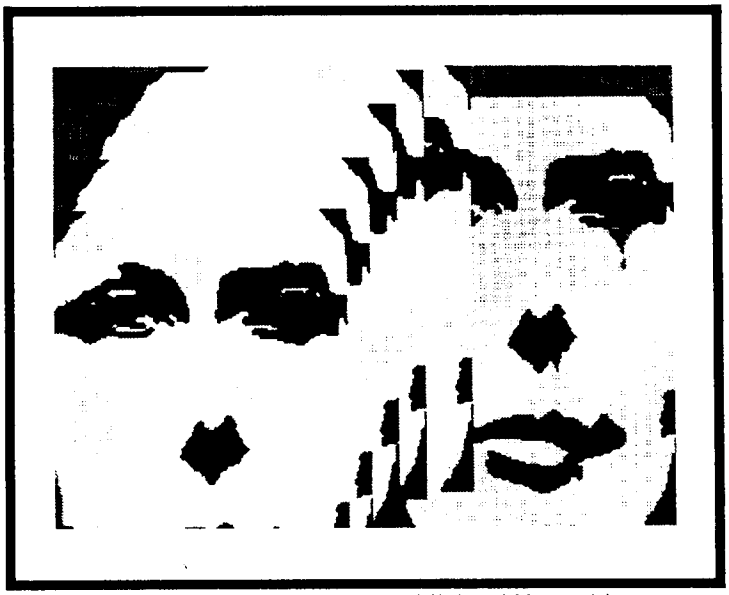
Fourth, such classifications of input patterns can constitute performances of many other kinds of tasks as well—connectionist nets are not limited to just pattern classification per se. For example, one net "classifies" written English into those character combinations and contexts appropriate to "this" phoneme, those appropriate to "that" phoneme, and so on—it produces the phonemes of spoken English from the characters of written English.

Fifth, such processing in these nets is similar in several ways to brain processing. Both are massively parallel. Both nets and the brain seem to involve generations and transmissions of levels of activation—levels of neural activity in the brain, perhaps levels of impulse frequencies. Even the errors that such nets make have been shown in several cases to be similar to those that humans make. It is clear why this approach has aroused excitement.

Churchland argues that these models provide a plausible and exciting alternative to sentential models, and that they yield many interesting consequences for other problems in philosophy and cognitive science. Much of the week of his visit was focused on discussion of these further consequences, when he wasn't taking bi-pictures.

Dr. Churchland's Selfridge Lecture, *Perception, Understanding, and Action: A Neural Network Account*, presented the case against sententialism, and introduced the connectionist-neuroscience alternative. He argued the many advantages that neural net "concepts," or classifiers, seem to have as a ground for accounts of mental phenomena.

One problem that emerges with connectionist accounts of cognition is that the process of training a net is very slow, and this makes it apparently difficult for the approach to handle fast conceptual change—such as theoretical insight in science. In *Some Further Thoughts on Learning and Conceptual Change*, a presentation for the Cognitive Science group, Dr. Churchland addressed this problem, suggesting that a solution might be the fast "re-deployment" of concepts already learned in old domains into new domains. This point connects strongly with accounts of the role of analogy and metaphor in scientific development.



(computerized image by Michael Keough)

In a philosophy of science class, Dr. Churchland argued, in *A Deeper Unity: Some Feyerabendian Themes in Neurocomputational Form*, that the neurocomputational model of cognitive activity and theoretical understanding provides strong support for a number of Feyerabendian themes of the philosophy of science, such as the theory-ladenness of perception, the incommensurability of competing paradigms, the displacibility of folk psychology, and the desirability of the proliferation of theories and methodologies in science.

In *A Neural Network for Fast Stereo Vision*, Dr. Churchland presented a network model that can identify relative planes of the convergence of stereo vision. It was fascinating to see how this network architecture could pick out parts of stereo scenes that were in front of or behind other parts.

There were also a number of props for this talk—a set of hand-held stereo viewers. These devices illuminate two pictures of a scene, taken from some distance apart which gives the stereo baseline—this is the distance between the eyes in normal stereo vision—and provide a viewing of those pictures, one in each eye. The stereo pictures are fused in the mind, providing stereo vision of the original scene.

The most interesting of these devices was one that Dr. Churchland had built himself for stereo viewing of slides that he had taken of many scenes around the world. If the stereo pair of slides are taken with a larger than normal separation—larger than the usual separation between the eyes—then the experience of viewing them is like looking at the scene with eyes that are feet or hundreds of feet apart, depending on how far apart the original slides were taken. An aerial view of San Francisco with a baseline of thousands of feet, and a wide baseline view of Yosemite valley, were two of the fascinating examples. The stereo views obtained in this way provide visual experiences that would not be possible otherwise.

Meanwhile, Dr. Churchland met on almost every day with the Philosophy Faculty Seminar where, in spite of all the nice things we have to say about Dr. Churchland's position above, we endeavored mightily to get him to see the errors of some of his ways. Unfortunately, it seems that all these hours and efforts at philosophico-therapy were to no avail: at last report, Dr. Churchland was still furtively taking double slides of things, not quite identical, whenever he thought he could get away with it.

Lehigh Events

17 October 1991
"Probabilistic Networks and Explanatory Coherence"
Paul Thagard
Center for Cognitive Science
Princeton University

When surprising events occur, people naturally try to generate explanations of them. Such explanations usually involve hypothesizing causes that have the events as effects. The many discussions of causal reasoning over the centuries fall in two traditions: explanationism and probabilism. Explanationists understand causal reasoning qualitatively, while probabilists exploit the resources of the probability calculus to understand causal reasoning quantitatively. In recent years, it has become possible to examine the differences between explanationist and probabilist approaches at a much finer level, because algorithms have been developed for implementing them computationally. The talk compared Thagard's theory of explanatory coherence, which has been implemented using connectionist methods and applied to many cases of scientific and everyday reasoning, with Judea Pearl's theory of Bayesian networks.

25 October 1991
"Constraints on Children's Causal Inferences about Story Events"
Brian Ackerman
Department of Psychology
University of Delaware

In some situations, young children fail to make causal inferences, whereas in others, they make too many inferences or adopt inferences that are contradictory. The speaker presented evidence from story comprehension studies suggesting that children and adults are differentially sensitive to constraints on inferences. More specifically, the research focused on factors affecting concept accessibility at encoding and the interaction of these factors with retrieval conditions, since these factors are likely to be implicated in developmental differences.

Experiments were described in which second- and fifth-graders and undergraduates listened to stories containing an early goal sentence and a later inconsistent outcome. Encoding factors included whether or not there were clues about the object's role in the outcome, the separation between clue and outcome, and whether the existence of the object was mentioned or implied. In addition, a number of retrieval factors were varied. These included the number and timing of the inferences that were probed, and the overlap between the clue and the probe information.

Across all experiments, object inferences depended on the extent to which the story focused on the object. It was also clear that weakly constrained inferences were more likely to be made in situations involving strong retrieval support, but that retrieval variables only have a minimal effect when the inference is strongly constrained. In general, with weakly constrained inferences, children were more affected by retrieval factors than were undergraduates.

The speaker suggested a number of explanations for these developmental differences. These included changes in the extent to which a given constraint is considered to be strongly or weakly constrained by the context; children's greater vulnerability to delays between the mention of an object and an outcome; and knowledge base differences that may influence the likelihood that a concept is activated when its existence is implied. Various retrieval factors also contributed to developmental differences. For example, the number of inferences probed had a greater affect on children than adults, and second-graders were more likely to offer a mutually exclusive inference when a strongly constrained inference was probed second. The speaker concluded by arguing for the importance of encoding and retrieval interactions in interpreting developmental differences in story inferences.

15 November 1991
"Using Sound to Solve Syntactic Problems, or Is a Noun a Noun by Any Other Name?"
Michael Kelley
Department of Psychology
University of Pennsylvania

One ubiquitous problem in language processing involves the assignment of words to the correct grammatical category, such as noun or verb. In general, semantic and syntactic information have been cited as the principle cues for grammatical category assignment, to the neglect of possible phonological cues. A number of theoretical assumptions about the nature of language could have led to this neglect (such as the general view that linguistic knowledge should be described as a set of rules). However, this neglect is not justified empirically. Thus, in his talk, the speaker claimed that (1) numerous correlations between the sound patterns of words and their grammatical categories exist, (2) some of these correlations are large and can pervade the entire lexicon of a language, (3) experiments have repeatedly shown that adults and children have learned these correlations, and (4) some explanations for how these correlations arose in the history of a language can be proposed and evaluated. The talk concluded by discussing the implications of these phenomena for various aspects of language processing.

5 December 1991
"Exploiting Language Transfer in an Instructional System For Deaf Writers"
Kathleen F. McCoy
Department of Computer and Information Sciences
University of Delaware

The speaker presented a method, developed with Linda Suri, for building a system that corrects ill-formed English text produced by writers learning English as a second language. This method was described within the framework of a system to correct English text produced by deaf writers whose native language is American Sign Language (ASL). ASL is a visual-gestural language which significantly

(continued on page 8)

Events (cont.)

differs from English in both its sentence-level grammar and its discourse strategies. Their model was based on the hypothesis that there is language transfer from ASL to English for deaf writers, and that transfer should be exploited in the identification and correction processes.

After explaining what language transfer is and how it might occur in writing, the speaker provided examples of sentence-level errors attributable to language transfer that have been uncovered in analyses of writing samples. For each example, she explained how the errors might be attributed to differences between ASL and English and how these differences might be exploited in the correction process. The architecture of a system that can detect and provide corrective responses to these errors was also discussed.

While researchers in second language acquisition have hypothesized and demonstrated language transfer at the sentence level, the speaker provided examples of discourse errors that are also attributable to language transfer. These errors could be corrected with the aid of a mechanism that tracks the discourse focus of written English and knowledge about ASL discourse strategies/rules.

23 January 1992
"From Sentences to Word Meanings: Taking the Low Road"
Michael R. Brent
Department of Cognitive Science
Johns Hopkins University

The syntactic structures in which a word can be used provide a reliable, low resolution picture of its meaning. For example, three-argument verbs that take a direct object and a that-clause, as in

Tell him that we'll arrive on Wednesday.

are all verbs of communication, such as "inform," "alert," "assure," "write," and so on. Lila Gleitman and her collaborators have argued that children can, must, and do exploit such regularities in learning verb meaning. In order for a child or an automated learner to exploit this information, though, it must be able to recover the syntactic privileges of words from the input. The talk described a computer program that does so, starting from a small vocabulary, a simple grammar of local cues, and some simple statistical manipulations.

Although the input and the initial knowledge of the computer program are significantly different than those of children, it suggests the types of manipulations that child learners might have to perform. The speaker described some of these discrepancies and his on-going work to build a highly realistic cognitive model.

The program was initially developed with a focus on the goals of natural language processing. To parse the following sentences one must know the distinct syntactic privileges of "tell," "doubt," "mumble," and "like":

John told [NP the man who mumbles] to arrive early.

John doubted [NP the man who likes to arrive early].

The lack of adequate dictionaries containing these features has been a major bottleneck for natural language processing. A new type of natural language system was developed to acquire this information from text, and the system is shown to be effective in acquiring a variety of syntactic features for hundreds of verbs.

6 March 1992
"Propositions and Images"
Patrick Hayes
Xerox Parc
Palo Alto, CA

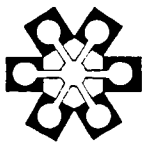
There is a traditional distinction between two kinds of representations, language-like and picture-like. The last 25 years has seen an ongoing dispute between the relative merits and psychological validity of these. There is however a way of looking at their semantics which suggests a similarity between them, and that they can be usefully regarded as extremes of a range of possible approaches to knowledge representation. The speaker explained this view of semantics by giving an outline of a model theory for maps, showing what a valid "map inference" is.

The speaker then applied this semantic theory to a new hybrid formalism for reasoning about actions and events, one whose terms are something like abstract images, and developed the syntax of this hybrid language using ideas from (elementary) group theory. The hybrid language has many of the advantages of some of Hayes's earlier work on action reasoning, but its new syntax avoids one crucial disadvantage.

10 April 1992
"Parallel Pathways in Human Vision"
John B. Siegfried
Pennsylvania College of Optometry
Philadelphia, PA

Recent studies in Monkey have shown that visual processing is accomplished by many parallel pathways that analyze the retinal image in different ways. Chief among these pathways are the Magno-pathway and the Parvo-pathway. Sophisticated visual stimuli, which make use of the known properties of cells in these pathways, have been programmed to attempt to activate selectively one or the other of these two pathways.

Results for human Visual Evoked Potential were presented that match, to a surprising degree, the results from individual cells in Monkey. In addition, results from stimuli designed to selectively activate the "On" pathways and the "Off" pathways, as well as lateral inhibitory pathways, were presented. Implications for our understanding of human perceptual processing, as well as for human aberrant perceptual processing, were then discussed.



What does a dyslexic agnostic insomniac do?

(Answer: Lies awake all night wondering whether there really is a dog.)

Meetings of Interest

Computation and Neural Systems Meeting

The first annual Computation and Neural Systems Meeting (CNS*92) will be held from July 26-31, 1992, in San Francisco, CA. It will be an interdisciplinary conference on the general aspects of computational neuroscience. Themes will include development, cell biology, excitable membranes and synaptic mechanisms, neurotransmitters, modulators and receptors, as well as sensory systems. For information contact:

Chris Ghinazzi
Lawrence Livermore National Laboratories
PO Box 808
Livermore, CA 94550

Cognitive Science Society

The 14th Annual Meeting of the Cognitive Science Society will be held July 29 - August 1, 1992, at Indiana University, Bloomington, Indiana. Plenary speakers for the conference are Elizabeth Bates, Daniel Dennett, Martha Farah, Douglas Hofstader, John Holland, Richard Schiffrin, and Michael Turvey. For more information, contact:

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Philosophy and the Cognitive Sciences

The Royal Institute of Philosophy is sponsoring a conference at the University of Birmingham on "Philosophy and the Cognitive Sciences" from September 11-14, 1992. The conference will address philosophical issues arising from cognitive science and the contributions cognitive science can make to the philosophy of mind. For further information, contact Chris Hookway (Philosophy) or Donald Peterson (Cognitive Science):

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The University of Birmingham
Birmingham, B15 2TT U.K.
e-mail: rip92@bham.ac.uk

First International Summer Institute in Cognitive Science

The Center for Cognitive Science of the State University of New York at Buffalo will present a four-week summer institute in July 1994. The preliminary dates are July 5-30, 1994. The project represents an important innovation in the cognitive science field; no venture of this type has ever been attempted before. The theme will be "multidisciplinary foundations of cognitive science".

It will be comprised of introductory and advanced courses in the constituent disciplines of cognitive science, which will be run during the first three weeks of the institute. Courses will be taught by both SUNY Buffalo faculty and invited faculty from other institutions. The fourth week will then be devoted to workshops and special conferences. There will also be a special lecture series running through the four weeks, with prominent scholars from the United States, Europe and Asia brought in to participate.

The model for this institute is the Summer Institute that the Linguistic Society of America has been sponsoring over the past 70 years, and there is an interesting historical analogy here. The LSA summer institutes began at a time when there were very few formal Departments of Linguistics or Linguistics Programs at American universities, and they served to provide a venue at which students and faculty at universities without any offerings in Linguistics could get training in the field.

Cognitive science is in a similar position today: there are very few Departments of Cognitive Science or degree-granting Cognitive Science Programs, and there are many universities and colleges with no organized offerings in this area at all. The Institute will provide an opportunity for many faculty and students to get an introduction to this field and to supplement discipline-based courses at their home institutions.

With respect to course offerings, two types of courses will be offered, introductory and advanced. The first and most important would be systematic introductory courses for advanced undergraduates or beginning graduate students in each of the major cognitive science disciplines: anthropology, artificial intelligence, linguistics, neuroscience, philosophy, and psychology. These courses will be designed for students with no background in that discipline but with expertise in another. Examples would be "Introduction to Cognitive Psychology," "Introduction to Cognitive Linguistics," "Introduction to Anthropology for Cognitive Scientists," "Introduction to Philosophy for Cognitive Scientists," and "Introduction to AI for Non-Computer Scientists." This would permit a student in, e.g., Psychology, to get an introduction to, e.g., Cognitive Linguistics and AI.

There will be two types of more advanced courses. The first is courses in specific disciplines, e.g., "Cognitive Semantics" (Linguistics), "Knowledge Representation" (Computer Science), "Cognitive Development" (Psychology). In addition to the six disciplines listed above, courses will also be offered in communicative disorders and cognitive geography.

The second type of course will be interdisciplinary, team-taught courses that bring together ideas and methods from more than one cognitive science discipline to bear on a particular problem, e.g., narrative, neuropsychology of cognitive development, vision.

It is anticipated that participants will include undergraduate and graduate students, faculty associates, and researchers from industry and government. For students, each course will meet for a total of 15 hours over the three weeks and will carry 1 semester unit of credit.

Detailed information on the Institute will be available in Summer 1992. If you wish to receive more information about exact course offerings, speaker series, workshops, fees, living accommodations, and scholarship and travel support (for students), please contact:

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NEW JOURNAL

Consciousness and Cognition: An International Journal

Bernard J. Baars and William P. Banks, editors

Aimed at scientific psychologists and neuroscientists, this new journal will provide a forum for a natural science approach to the issues of conscious experience, voluntary control, and self. There are currently numerous studies on topics such as EEG correlates of decision-making, automaticity in practiced skills, sub-and supra-liminal signal detection, the thalamocortical complex, priming, selective attention, implicit memory, development of the self-concept, blind sight, locus of control and the like. Such research bears directly on a scientific understanding of the three main issues of consciousness, voluntary control, and self, but often do not explore these connections in detail. The aim of ***Consciousness and Cognition*** is to facilitate integration of the established empirical literature on these topics with novel approaches, both empirical and theoretical. The journal aims therefore to be both rigorous scientifically *and* open to novel contributions. The editors welcome submissions from cognitive and neuroscientists; social, developmental, and personality researchers; linguists; philosophers of science; and others. Empirical studies, theoretical integrations, coherent literature surveys, and public peer commentary are encouraged.

Consciousness and Cognition will appear quarterly, starting in 1992. Manuscripts should be submitted in quadruplicate (one original and three photocopies) to:

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